

metallic surface, whereby it is able to spread itself over the latter and to resist removal and dispersion. This quality is designated "oiliness" and may be defined as that property of a lubricant in virtue of which it maintains an unbroken film under a heavy load. In respect of oiliness mineral oils, which are hydrocarbons, are inferior to fixed oils, which are compounds of an alcohol and an acid, and for this reason mineral oils are improved as lubricants for ordinary machinery by blending with fatty oils.

Classification of Lubricants.—Lubricants may be divided into the following groups:

1. Vegetable and animal oils and fats and liquid waxes. Examples of this group are rape, castor, and sperm oils.
2. Mineral oils, derived from the fractions of petroleum and shale oil boiling above 570° F.
3. Blended oils, prepared from mineral oils with an admixture of vegetable or animal oil. Boiled vegetable oils are sometimes incorporated with mineral oils to give these the consistency necessary for heavy machinery.
4. Solid lubricants, including graphite, French chalk, or mica, with or without addition of grease. Greases used alone may consist of natural fat or of a mixture of mineral or fatty oil with a soap compounded of lime or aluminium with a fatty or resin acid. Aquadag and oildag are preparations of artificial graphite in the colloidal state dispersed in water or in oil.
5. Lubricants for use with cutting tools, and consisting usually of a solution of soft soap and soda in water.

Testing of Lubricating Oils.—The following physical tests are commonly relied upon in determining the quality of a lubricating oil and its suitability for a particular purpose:

6. Specific gravity.
7. Viscosity.
8. Flash-point.
9. Setting-point.

The property of oiliness is meantime not readily subject to direct measurement and can be tested only comparatively on a suitable machine. For the determination of *specific gravity* the specific-gravity bottle is in general use. The Westphal balance and the Sprengel tube are also employed. *Viscosity*

is determined in practice by the time required for a definite volume at a given temperature to pass through a standard opening under a specified head or pressure. Redwood's viscometer is the recognized instrument in use for the purpose in this country, and the viscosity at a given temperature is the number of seconds required for 50 c. c. to emerge from the orifice of a standard cup filled to a definite height. Determinations are done at 60° F. (if possible), and at two higher temperatures suggested by the conditions under which the oil is to be used.

The *flash-point* is the temperature at which an oil gives off vapour fast enough to produce an explosive mixture with air either in an open cup (open